OIPE IAP48
SEP 19 2006
PATENT & TRADEMARK OFFICE

FIG.1

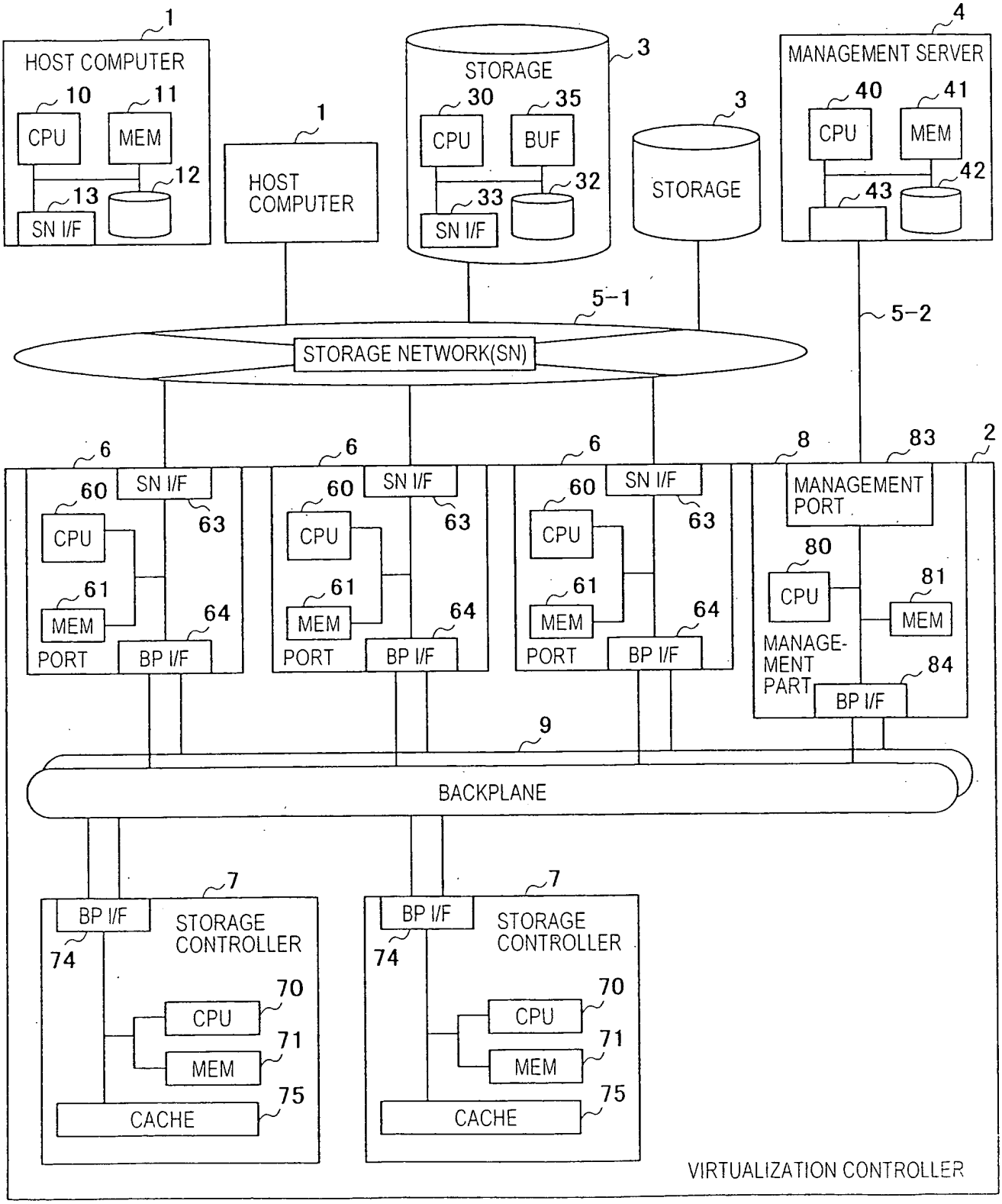


FIG.2

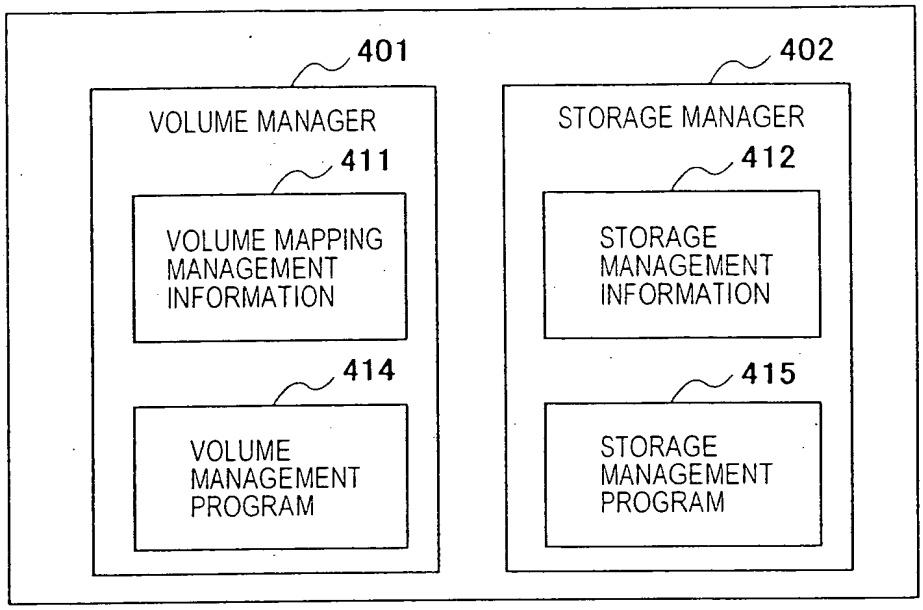

401
VOLUME MANAGER
411
VOLUME MAPPING MANAGEMENT INFORMATION
414
VOLUME MANAGEMENT PROGRAM
402
STORAGE MANAGER
412
STORAGE MANAGEMENT INFORMATION
415
STORAGE MANAGEMENT PROGRAM

FIG.3

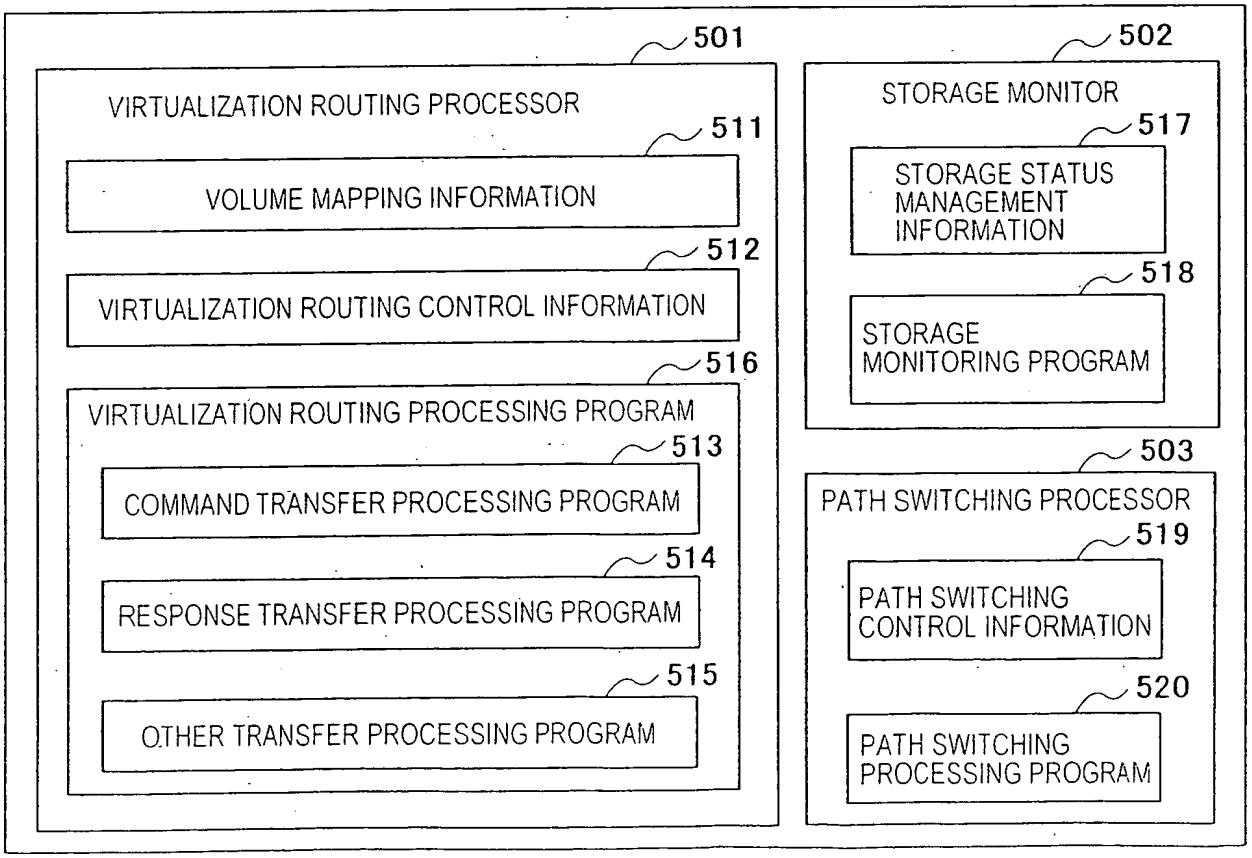
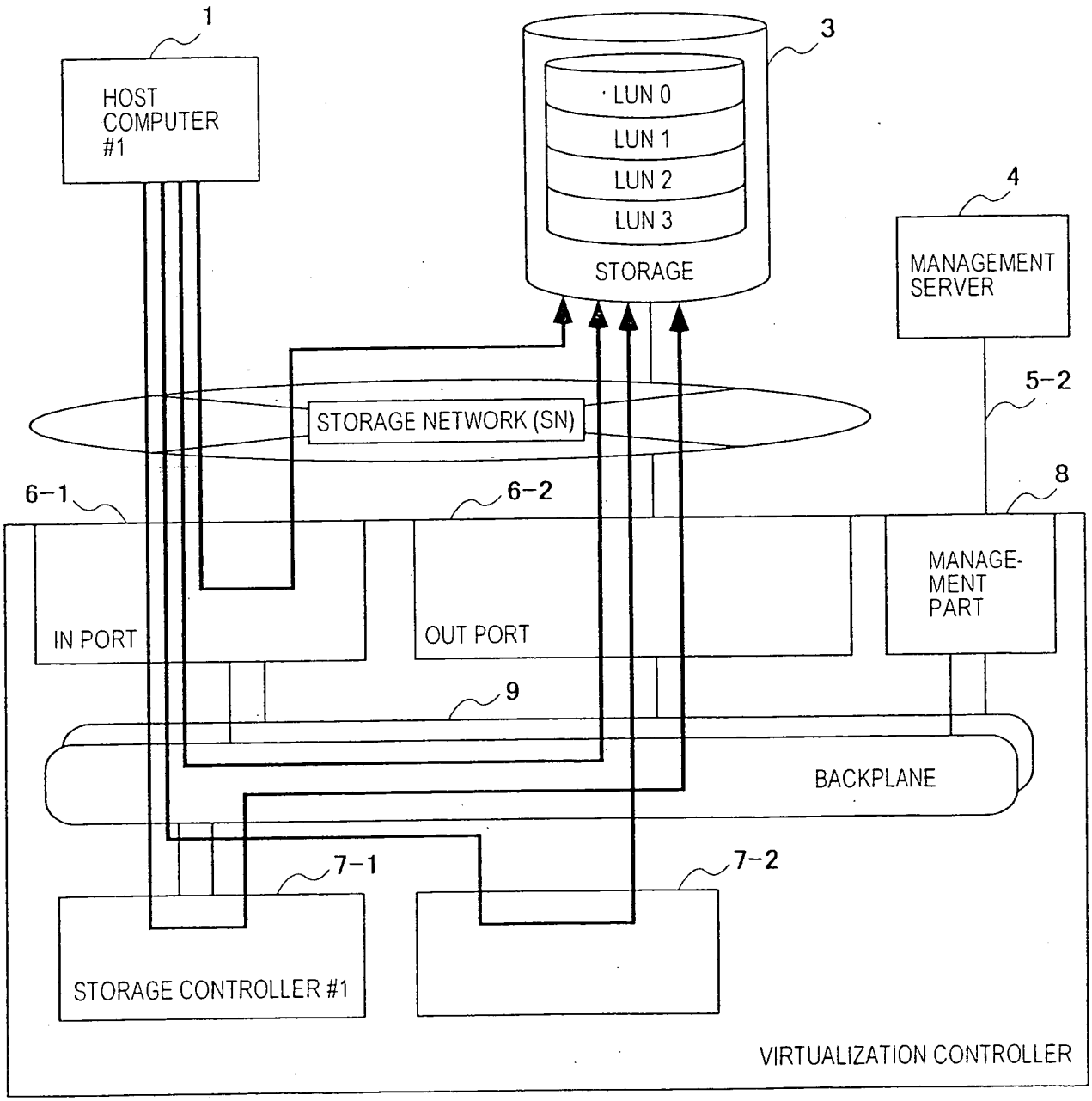

501
VIRTUALIZATION ROUTING PROCESSOR
511
VOLUME MAPPING INFORMATION
512
VIRTUALIZATION ROUTING CONTROL INFORMATION
516
VIRTUALIZATION ROUTING PROCESSING PROGRAM
513
COMMAND TRANSFER PROCESSING PROGRAM
514
RESPONSE TRANSFER PROCESSING PROGRAM
515
OTHER TRANSFER PROCESSING PROGRAM
502
STORAGE MONITOR
517
STORAGE STATUS MANAGEMENT INFORMATION
518
STORAGE MONITORING PROGRAM
503
PATH SWITCHING PROCESSOR
519
PATH SWITCHING CONTROL INFORMATION
520
PATH SWITCHING PROCESSING PROGRAM

FIG.4


1
HOST COMPUTER #1
3
LUN 0
LUN 1
LUN 2
LUN 3
STORAGE
4
MANAGEMENT SERVER
5-2
STORAGE NETWORK (SN)
8
6-1
6-2
IN PORT
OUT PORT
MANAGE-MENT PART
9
BACKPLANE
7-1
7-2
STORAGE CONTROLLER #1
VIRTUALIZATION CONTROLLER

Replacement Sheet

FIG. 5

511

VIRTUAL VOLUME MANAGEMENT INFORMATION (531)			REAL VOLUME MANAGEMENT INFORMATION (532)			VIRTUALIZATION PROCESSING MODULE MANAGEMENT INFORMATION (533)	STORAGE CONNECTION MODULE MANAGEMENT INFORMATION (534)	COMMAND PROCESSING MODE (535)
PORT ID	PORT NAME	LUN	PORT ID	PORT NAME	LUN			
V_PID_1	V_PNAME_1	0	V_PID_1	V_PNAME_1	0	STORAGE CONTROLLER #1	OUT PORT	NORMAL
V_PID_2	V_PNAME_2	0	V_PID_1	V_PNAME_1	1	STORAGE CONTROLLER #1	OUT PORT	NORMAL
V_PID_3	V_PNAME_3	0	V_PID_1	V_PNAME_1	2	OUT PORT	OUT PORT	NORMAL
V_PID_4	V_PNAME_4	0	V_PID_1	V_PNAME_1	3	OUT PORT	OUT PORT	NORMAL
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

FIG. 6

512

SENDING SOURCE MANAGEMENT INFORMATION (541)		SENDING DESTINATION MANAGEMENT INFORMATION (542)	
SENDING SOURCE IDENTIFICATION INFORMATION	SENDING SOURCE COMMAND IDENTIFICATION INFORMATION	DESTINATION IDENTIFICATION INFORMATION	COMMAND IDENTIFICATION INFORMATION
HOST_PID_1	HOST_TAG_1	STORAGE CONTROLLER #1	INPORT_TAG_1
HOST_PID_1	HOST_TAG_2	STORAGE CONTROLLER #1	INPORT_TAG_2
HOST_PID_1	HOST_TAG_3	OUT PORT	INPORT_TAG_3
HOST_PID_1	HOST_TAG_4	OUT PORT	INPORT_TAG_4
⋮	⋮	⋮	⋮

FIG.7

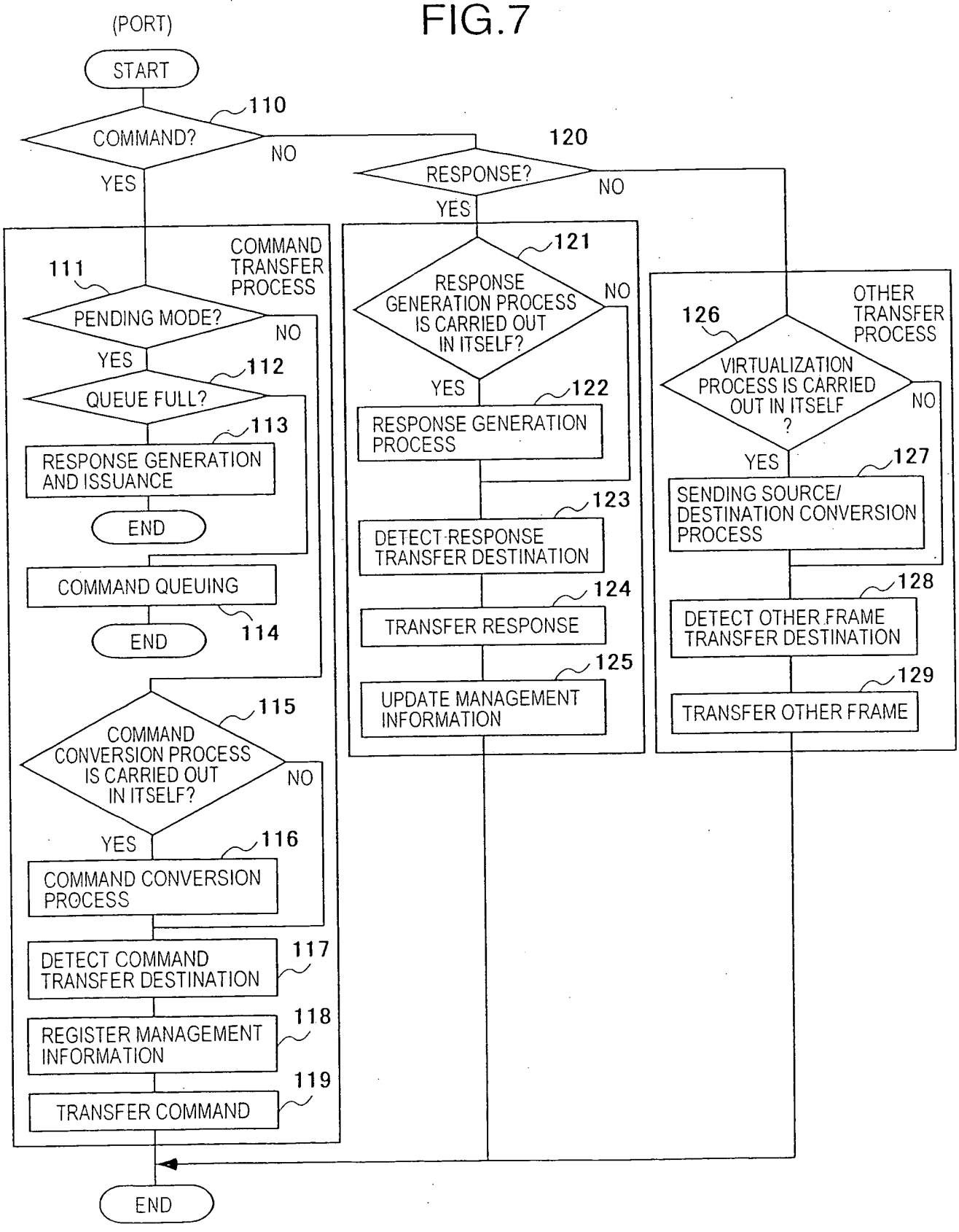

(PORT)
START
110
COMMAND?
NO
YES
120
RESPONSE?
NO
YES
COMMAND TRANSFER PROCESS
111
PENDING MODE?
NO
YES
112
QUEUE FULL?
113
RESPONSE GENERATION AND ISSUANCE
END
COMMAND QUEUING
114
END
115
COMMAND CONVERSION PROCESS IS CARRIED OUT IN ITSELF?
NO
YES
116
COMMAND CONVERSION PROCESS
DETECT COMMAND TRANSFER DESTINATION
117
REGISTER MANAGEMENT INFORMATION
118
TRANSFER COMMAND
119
121
RESPONSE GENERATION PROCESS IS CARRIED OUT IN ITSELF?
NO
YES
122
RESPONSE GENERATION PROCESS
123
DETECT RESPONSE TRANSFER DESTINATION
124
TRANSFER RESPONSE
125
UPDATE MANAGEMENT INFORMATION
OTHER TRANSFER PROCESS
126
VIRTUALIZATION PROCESS IS CARRIED OUT IN ITSELF ?
NO
YES
127
SENDING SOURCE/ DESTINATION CONVERSION PROCESS
128
DETECT OTHER FRAME TRANSFER DESTINATION
129
TRANSFER OTHER FRAME
END

FIG.8

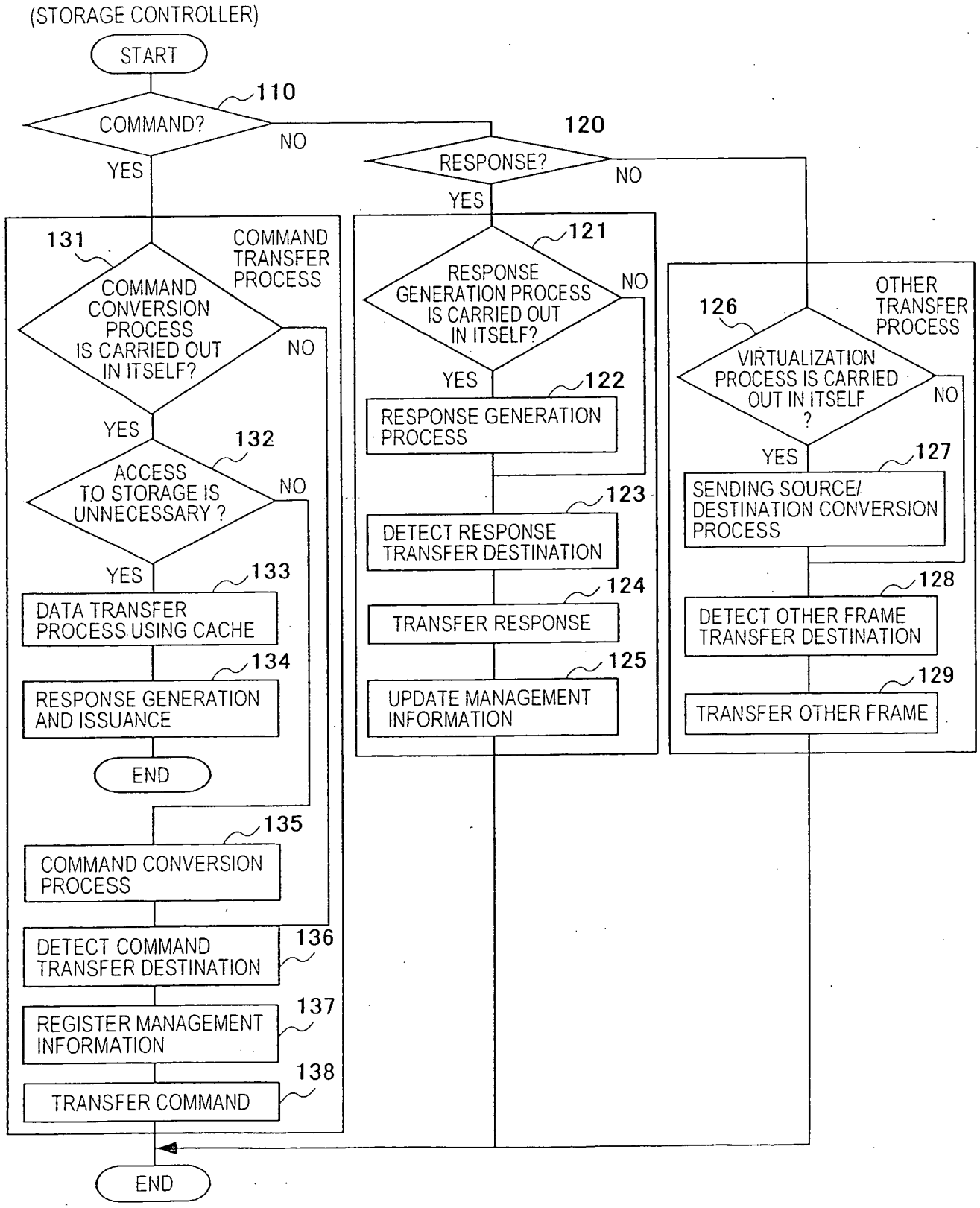

(STORAGE CONTROLLER)
START
110
COMMAND?
NO
YES
120
RESPONSE?
NO
YES
131
COMMAND TRANSFER PROCESS
COMMAND CONVERSION PROCESS IS CARRIED OUT IN ITSELF?
NO
YES
132
ACCESS TO STORAGE IS UNNECESSARY ?
NO
YES
133
DATA TRANSFER PROCESS USING CACHE
134
RESPONSE GENERATION AND ISSUANCE
END
135
COMMAND CONVERSION PROCESS
136
DETECT COMMAND TRANSFER DESTINATION
137
REGISTER MANAGEMENT INFORMATION
138
TRANSFER COMMAND
END
121
RESPONSE GENERATION PROCESS IS CARRIED OUT IN ITSELF?
NO
YES
122
RESPONSE GENERATION PROCESS
123
DETECT RESPONSE TRANSFER DESTINATION
124
TRANSFER RESPONSE
125
UPDATE MANAGEMENT INFORMATION
OTHER TRANSFER PROCESS
126
VIRTUALIZATION PROCESS IS CARRIED OUT IN ITSELF ?
NO
YES
127
SENDING SOURCE/ DESTINATION CONVERSION PROCESS
128
DETECT OTHER FRAME TRANSFER DESTINATION
129
TRANSFER OTHER FRAME

FIG.9

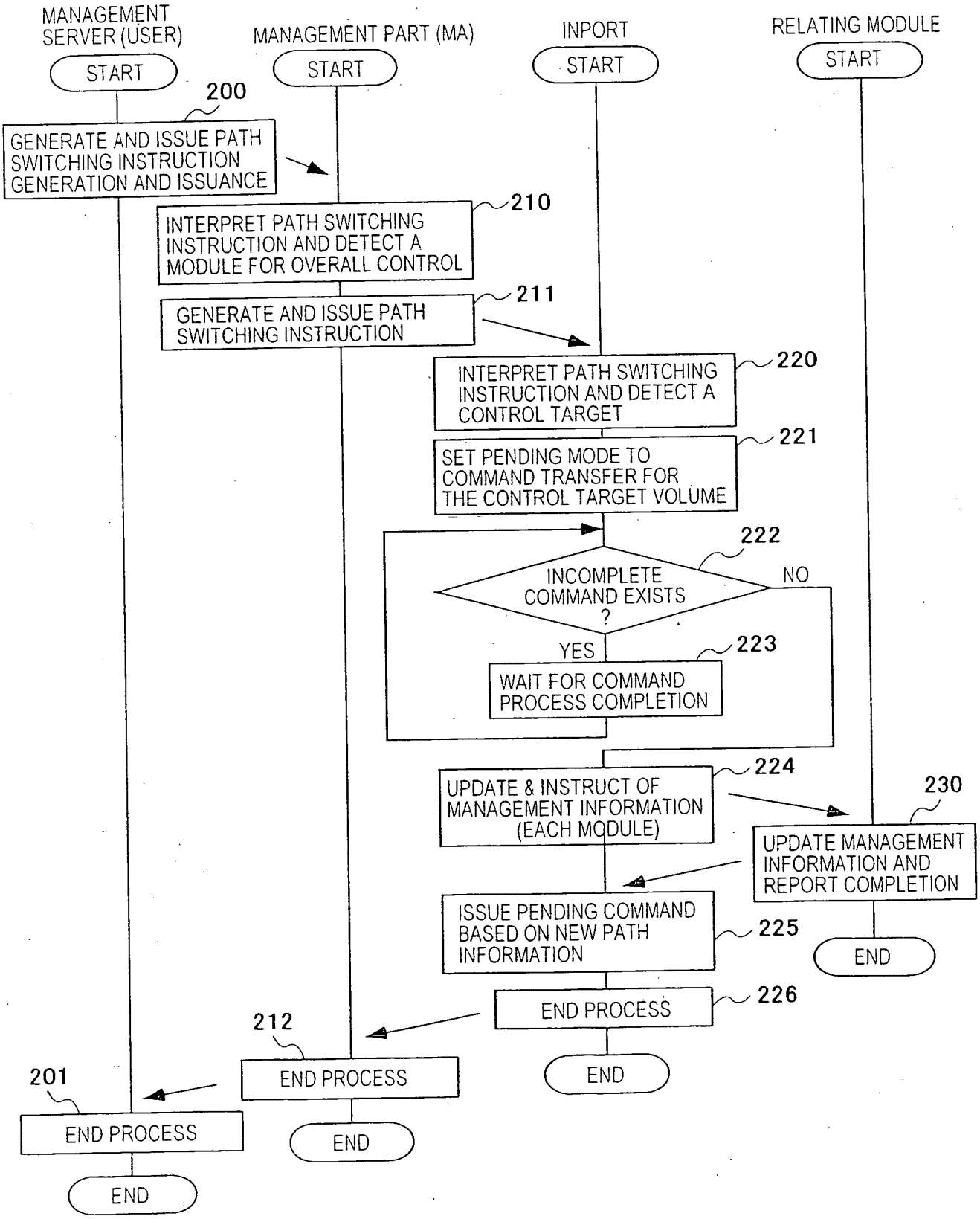

MANAGEMENT SERVER (USER)
START
200
GENERATE AND ISSUE PATH SWITCHING INSTRUCTION GENERATION AND ISSUANCE
201
END PROCESS
END
MANAGEMENT PART (MA)
START
210
INTERPRET PATH SWITCHING INSTRUCTION AND DETECT A MODULE FOR OVERALL CONTROL
211
GENERATE AND ISSUE PATH SWITCHING INSTRUCTION
212
END PROCESS
END
INPORT
START
220
INTERPRET PATH SWITCHING INSTRUCTION AND DETECT A CONTROL TARGET
221
SET PENDING MODE TO COMMAND TRANSFER FOR THE CONTROL TARGET VOLUME
222
INCOMPLETE COMMAND EXISTS ?
NO
YES
223
WAIT FOR COMMAND PROCESS COMPLETION
224
UPDATE & INSTRUCT OF MANAGEMENT INFORMATION (EACH MODULE)
225
ISSUE PENDING COMMAND BASED ON NEW PATH INFORMATION
226
END PROCESS
END
RELATING MODULE
START
230
UPDATE MANAGEMENT INFORMATION AND REPORT COMPLETION
END

FIG.10

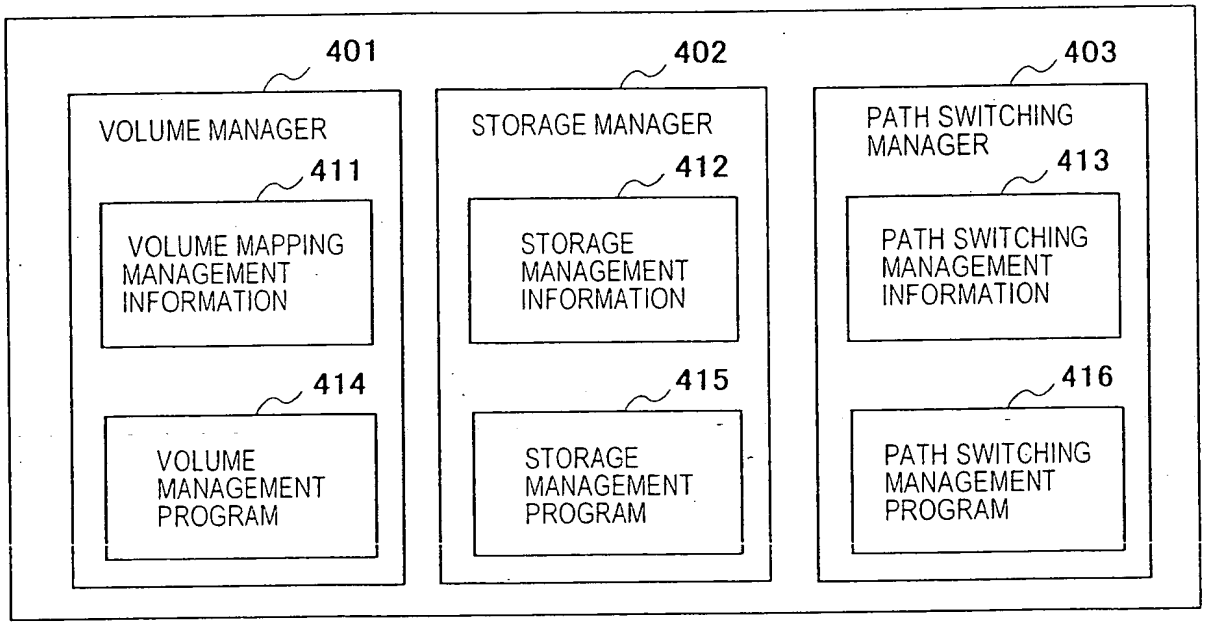

401
VOLUME MANAGER
411
VOLUME MAPPING MANAGEMENT INFORMATION
414
VOLUME MANAGEMENT PROGRAM
402
STORAGE MANAGER
412
STORAGE MANAGEMENT INFORMATION
415
STORAGE MANAGEMENT PROGRAM
403
PATH SWITCHING MANAGER
413
PATH SWITCHING MANAGEMENT INFORMATION
416
PATH SWITCHING MANAGEMENT PROGRAM

FIG.11

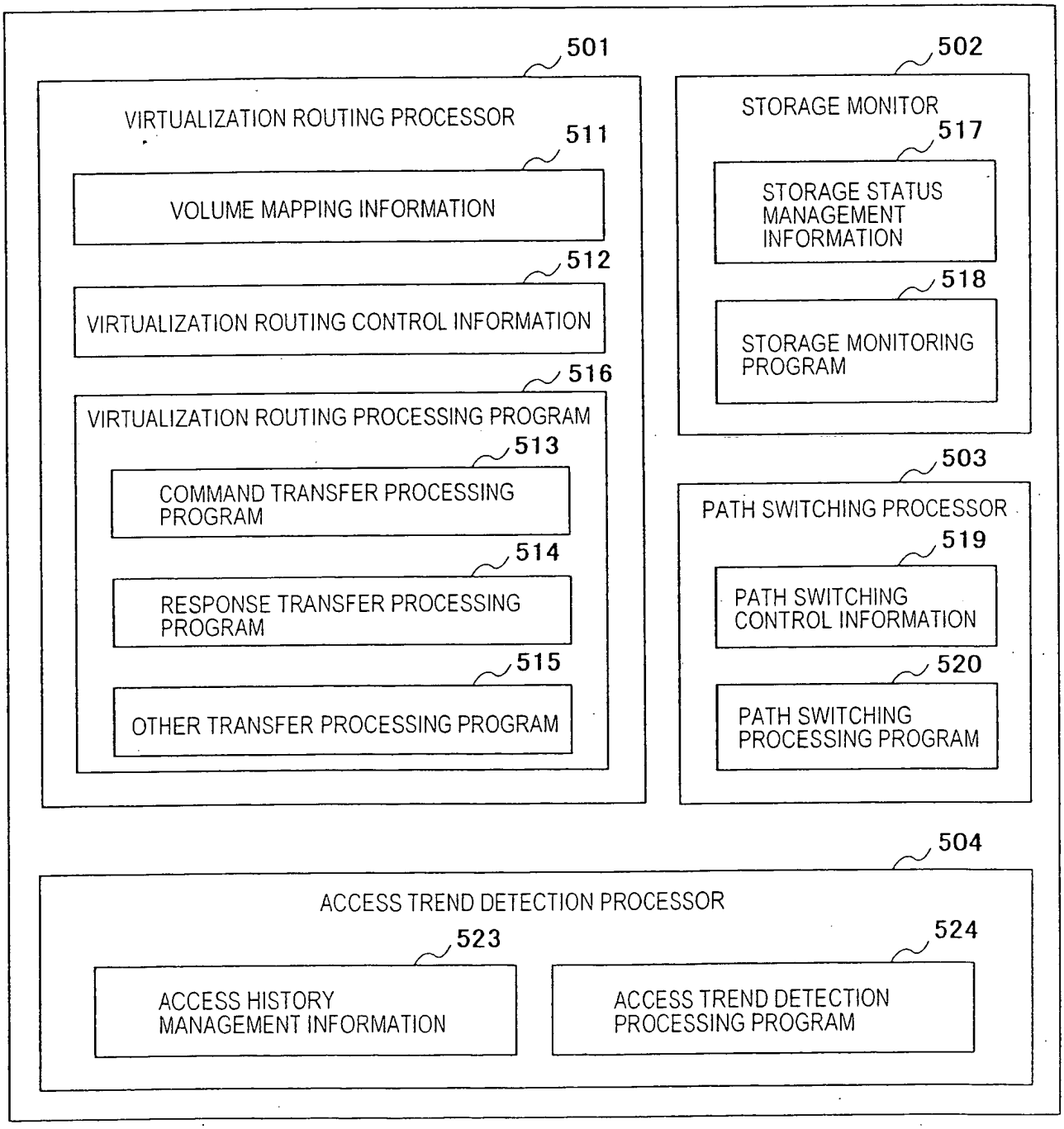

501
VIRTUALIZATION ROUTING PROCESSOR
511
VOLUME MAPPING INFORMATION
512
VIRTUALIZATION ROUTING CONTROL INFORMATION
516
VIRTUALIZATION ROUTING PROCESSING PROGRAM
513
COMMAND TRANSFER PROCESSING PROGRAM
514
RESPONSE TRANSFER PROCESSING PROGRAM
515
OTHER TRANSFER PROCESSING PROGRAM
502
STORAGE MONITOR
517
STORAGE STATUS MANAGEMENT INFORMATION
518
STORAGE MONITORING PROGRAM
503
PATH SWITCHING PROCESSOR
519
PATH SWITCHING CONTROL INFORMATION
520
PATH SWITCHING PROCESSING PROGRAM
504
ACCESS TREND DETECTION PROCESSOR
523
ACCESS HISTORY MANAGEMENT INFORMATION
524
ACCESS TREND DETECTION PROCESSING PROGRAM

FIG.12

ACCESS TYPE (550)		WEIGHED FACTOR (551)
READ TYPE ACCESS	PROXIMAL ACCESS	2
	IDENTICAL ADDRESS ACCESS	1
	CONTINUOUS ADDRESS ACCESS	-1
	OTHER ACCESS (THE FIRST ACCESS)	0
WRITE TYPE ACCESS	ROXIMAL ACCESS	0
	IDENTICAL ADDRESS ACCESS	1
	CONTINUOUS ADDRESS ACCESS	-2
	OTHER ACCESS (THE FIRST ACCESS)	0

FIG.13

ACCESS TYPE (523)		LUN 0	LUN 1 (552)	LUN 2	LUN 3
READ TYPE ACCESS	PROXIMAL ACCESS	100	50	10	0
	IDENTICAL ADDRESS ACCESS	100	50	10	0
	CONTINUOUS ADDRESS ACCESS	0	10	100	0
	OTHER ACCESS	10	10	10	10
WRITE TYPE ACCESS	ROXIMAL ACCESS	10	50	0	0
	IDENTICAL ADDRESS ACCESS	10	50	0	0
	CONTINUOUS ADDRESS ACCESS	0	10	0	100
	OTHER ACCESS	10	10	0	10

FIG.14

523 552

ACCESS TYPE		LUN 0	LUN 1	LUN 2	LUN 3
READ TYPE ACCESS	PROXIMAL ACCESS	10	50	10	0
	IDENTICAL ADDRESS ACCESS	10	50	10	0
	CONTINUOUS ADDRESS ACCESS	200	10	100	0
	OTHER ACCESS	10	10	10	10
WRITE TYPE ACCESS	ROXIMAL ACCESS	0	50	0	0
	IDENTICAL ADDRESS ACCESS	0	50	0	0
	CONTINUOUS ADDRESS ACCESS	0	10	0	100
	OTHER ACCESS	10	10	0	10

FIG.15

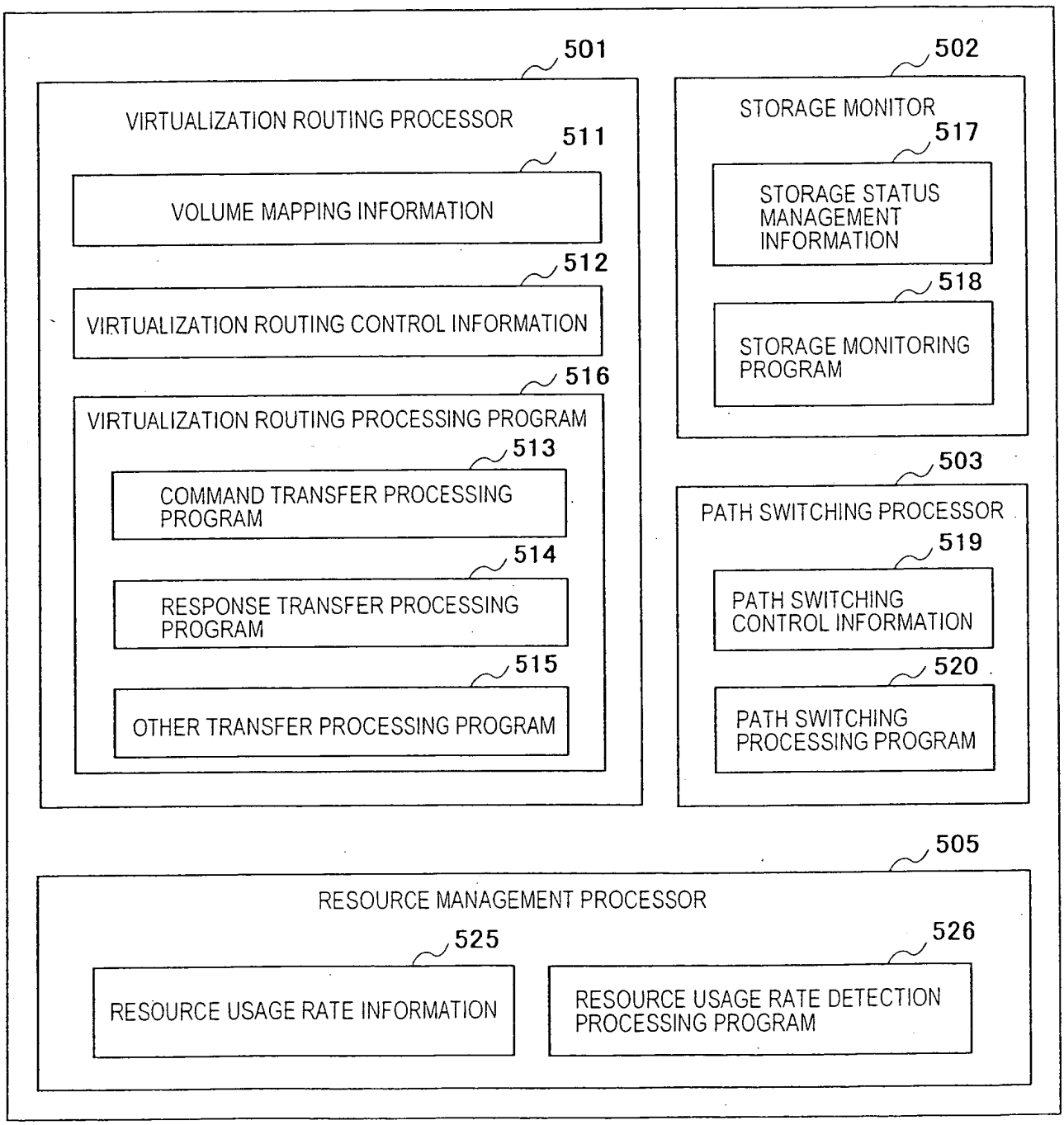

501
VIRTUALIZATION ROUTING PROCESSOR
511
VOLUME MAPPING INFORMATION
512
VIRTUALIZATION ROUTING CONTROL INFORMATION
516
VIRTUALIZATION ROUTING PROCESSING PROGRAM
513
COMMAND TRANSFER PROCESSING PROGRAM
514
RESPONSE TRANSFER PROCESSING PROGRAM
515
OTHER TRANSFER PROCESSING PROGRAM
502
STORAGE MONITOR
517
STORAGE STATUS MANAGEMENT INFORMATION
518
STORAGE MONITORING PROGRAM
503
PATH SWITCHING PROCESSOR
519
PATH SWITCHING CONTROL INFORMATION
520
PATH SWITCHING PROCESSING PROGRAM
505
RESOURCE MANAGEMENT PROCESSOR
525
RESOURCE USAGE RATE INFORMATION
526
RESOURCE USAGE RATE DETECTION PROCESSING PROGRAM

FIG.16

(MANAGEMENT PART)

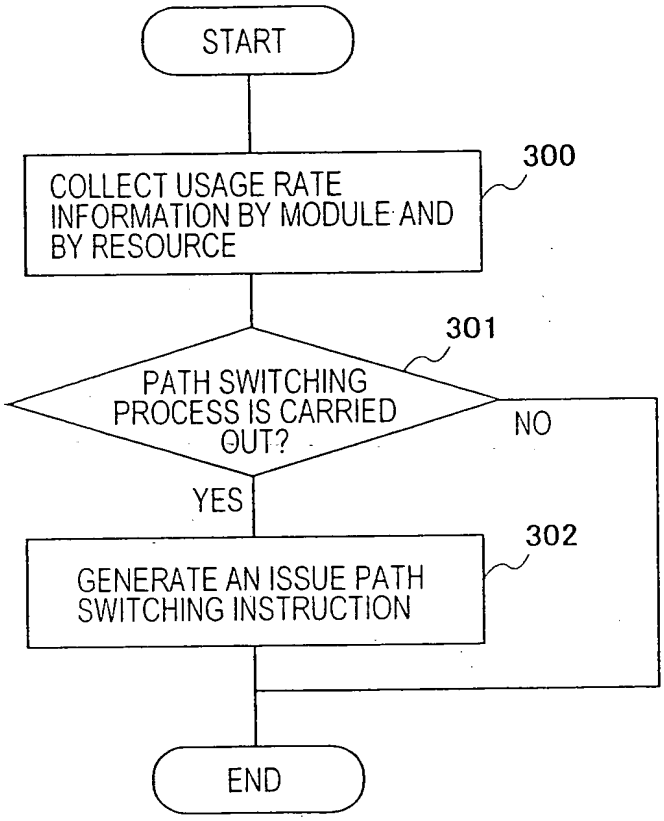


FIG.17

511

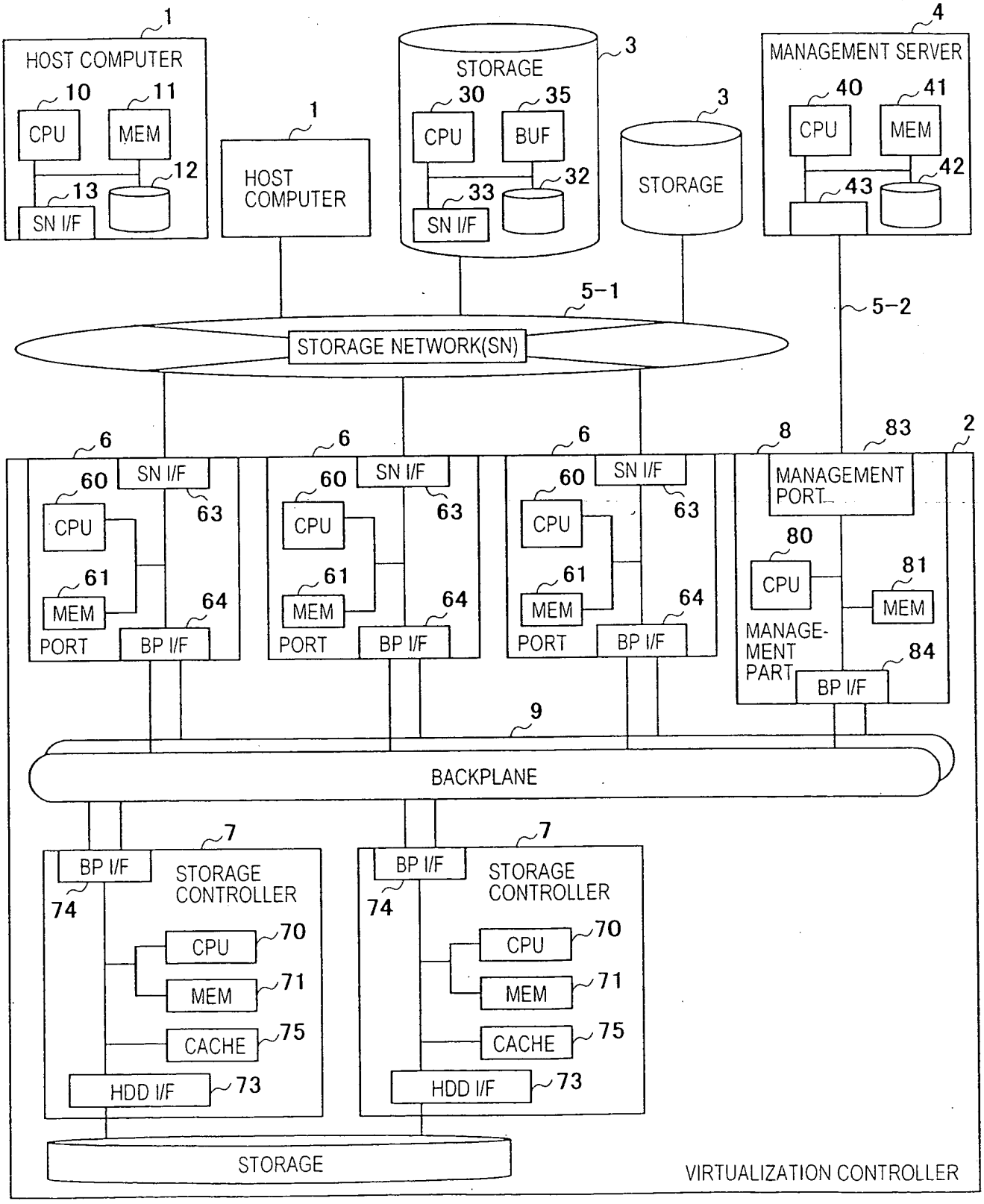
531 VIRTUAL VOLUME MANAGEMENT INFORMATION				532 REAL VOLUME MANAGEMENT INFORMATION			533 VIRTUALIZATION PROCESSING MODULE MANAGEMENT INFORMATION	534 STORAGE CONNECTION MODULE MANAGEMENT INFORMATION	535 COMMAND PROCESSING MODE
PORT ID	PORT NAME	LUN	ADDRESS	PORT ID	PORT NAME	LUN			
V_PID_1	V_PNAME_1	0	0h～98967Fh 989680h～1312CFFh	P_PID_1	P_PNAME_1	0 4	STORAGE CONTROLLER #1	OUT PORT	NORMAL
V_PID_2	V_PNAME_2	0	0h～1312CFFh	P_PID_1	P_PNAME_1	1	STORAGE CONTROLLER #1	OUT PORT	NORMAL
V_PID_3	V_PNAME_3	0	0h～1312CFFh	P_PID_1	P_PNAME_1	2	OUT PORT	OUT PORT	NORMAL
V_PID_4	V_PNAME_4	0	0h～1312CFFh	P_PID_1	P_PNAME_1	3	OUT PORT	OUT PORT	NORMAL
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

FIG.18

511

531 VIRTUAL VOLUME MANAGEMENT INFORMATION				532 REAL VOLUME MANAGEMENT INFORMATION			533 VIRTUALIZATION PROCESSING MODULE MANAGEMENT INFORMATION	534 STORAGE CONNECTION MODULE MANAGEMENT INFORMATION	535 COMMAND PROCESSING MODE
PORT ID	PORT NAME	LUN	ADDRESS	PORT ID	PORT NAME	LUN			
V_PID_1	V_PNAME_1	0	0h～98967Fh 989680h～1312CFFh	P_PID_1	P_PNAME_1	0 4	STORAGE CONTROLLER #1	OUT PORT	NORMAL
V_PID_2	V_PNAME_2	0	0h～1312CFFh	P_PID_1	P_PNAME_1	1	STORAGE CONTROLLER #1	OUT PORT	NORMAL
V_PID_3	V_PNAME_3	0	0h～1312CFFh	P_PID_1	P_PNAME_1	2	OUT PORT	OUT PORT	NORMAL
V_PID_1	V_PNAME_1	3	0h～1312CFFh	P_PID_1	P_PNAME_1	3	OUT PORT	OUT PORT	NORMAL
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

FIG.19


1
HOST COMPUTER
10
CPU
11
MEM
12
13
SN I/F
1
HOST COMPUTER
3
STORAGE
30
CPU
35
BUF
32
33
SN I/F
3
STORAGE
4
MANAGEMENT SERVER
40
CPU
41
MEM
42
43
5-1
5-2
STORAGE NETWORK(SN)
6
60
SN I/F
63
CPU
61
MEM
64
PORT
BP I/F
8
83
2
MANAGEMENT PORT
80
CPU
81
MEM
MANAGE-MENT PART
84
BP I/F
9
BACKPLANE
7
BP I/F
74
STORAGE CONTROLLER
CPU
70
MEM
71
CACHE
75
HDD I/F
73
STORAGE
VIRTUALIZATION CONTROLLER